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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

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INVENTOR(S)		
Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
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Additional inventors are being named on the ______ *separately numbered sheets attached hereto*

TITLE OF THE INVENTION (500 characters max)

Radial Flow Filter With Bottom Fluidizing Port

Direct all correspondence to: **CORRESPONDENCE ADDRESS**

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ENCLOSED APPLICATION PARTS *(check all that apply)*

- [X] Specification *Number of Pages* 6
- [X] Drawing(s) *Number of Sheets* 3
- [ ] Application Data Sheet. See 37 CFR 1.76
- [ ] CD(s), Number ______
- [ ] Other (specify) ______

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT

- [X] Applicant claims small entity status. See 37 CFR 1.27.
- [X] A check or money order is enclosed to cover the filing fees.
- [X] The Director is herby authorized to charge filing fees or credit any overpayment to Deposit Account Number: 502112/jmar
- [ ] Payment by credit card. Form PTO-2038 is attached.

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The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

- [X] No.
- [ ] Yes, the name of the U.S. Government agency and the Government contract number are: ______

Respectfully submitted,

SIGNATURE [signature]

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REGISTRATION NO. 29,753
(if appropriate)
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USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

RADIAL FLOW FILTER WITH BOTTOM FLUIDIZING PORT

By:

John D. Martin

EXPRESS MAIL NO. ER 566994337 US
I hereby certify that this correspondence is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated below and is addressed to M/S Provisional Application, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on

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Roger N. Chauza (Name of Depositor)
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Technical Field Of The Invention

The present invention relates in general to filters and associated filter systems, and more particularly to radial flow filters of the type that allow the media to be fluidized external thereto.

Detailed Description

Fig. 1 illustrates a device 10, although in practice it may be much longer in length, up to six foot or more, depending on the surface area of filter media desired. The device 10 includes a top end cap12 and a bottom end cap 14. Both top and bottom end caps 12 and 14 may be constructed in an identical manner, using the same mold. The end caps can be constructed of plastic, metal or other suitable material.

Supported between the end caps 12 and 14 is an outer cylindrical case 16 that is supported between respective annular recesses in the top and bottom end caps 12 and 14. The case 16 can be welded or threaded to the top and bottom end caps 12 and 14 to constrain the perforated cylinders 22 and 32 between the end caps 12 and 14. O-rings 18 and 20 provide a fluid seal between the case 16 and the top and bottom end caps 12 and 14.

The top and bottom end caps 12 and 14 further include other respective annular recesses for supporting therebetween an outer perforated cylinder 22. The outer perforated cylinder 22 may be plastic or metal with large openings 24 formed therein. The openings 24 are formed generally throughout the entire length of the outer perforated cylinder 22. (However, the perforations can be formed along any desired portion thereof). This allows the entire surface area of the outer perforated cylinder 22 to receive a radial flow of influent. A screen 26 is attached to the inside surface of the outer perforated cylinder 22. O-rings 28 and 30 provide a fluid seal between the outer perforated cylinder 22 and the respective top and bottom end caps 12 and 14.

An inner perforated cylinder 32 is supported within respective bores (not shown) formed centrally in the top and bottom end caps 12 and 14. O-rings (not shown) provide a fluid seal between the ends of the top and bottom ends of the inner perforated cylinder 32 and the respective bores of the top and bottom end caps 12 and 14. Large perforations 34 are formed in the inner perforated cylinder 32 from the top to the bottom thereof. A screen 36 is attached to the outer surface of the inner perforated cylinder 32. The screen 26 held against the inside surface of the outer perforated cylinder 22, and the screen 36 held against the outer surface of the inner perforated cylinder 32, are of a mesh or porosity for containing the media 40 placed in the annular chamber 38 between such screens 26 and 36.

A media, such as beads, activated carbon, particulate zirconium or any other filter material 40 is carried to the device 10 to fill the annular chamber 38. The media material 40 can also be of any other material that coacts with the influent, rather than filters the influent. The annular chamber is called the media chamber 38. The particles of the media 40 are preferably larger in diameter than the screens 26 and 32, although they may be smaller when desired. The media 40 can be injected into the media chamber 38 either by way of a channel 44 located in the top end cap 12, or the bottom channel 42 located in the bottom end cap 14. In the preferred embodiment, the media 40 fills the media chamber 38. During regeneration of the media 40, the media 40 is removed from the device 10 through a channel 42 located in the bottom end cap 14.

While the top end cap 12 and the bottom end cap 14 are shown with a single media inlet channel 44 and outlet channel 42, such end caps can be constructed with multiple channels to facilitate the inlet and outlet of the media 40 with respect to the device 10. In order to allow uniform distribution of the media around the media chamber 38, two inlet channels 44 can be formed oppositely in the top end cap 12. Similarly, for complete removal of the media 40 from the

media chamber 38 during regeneration thereof, two outlet channels can be oppositely located in the bottom end cap 14. As yet another alternative to the end cap design, the top end cap can be constructed with one or more inlet channels (not shown) opening to an annular groove which will function to uniformly distribute the media 40 around the annular-shaped media chamber 38. The bottom end cap 14 can be formed with a similar structure to assure that the media 40 can be completely removed from the media chamber 38 during the regeneration cycle. As will be described more fully below, the media 40 is removed from the device 10 by a fluidization process, and coupled to a regeneration container for either removing the filtered particulate matter from the filter media, or for regenerating the media chemically or otherwise to reconstitute it to its pristine state.

The inner perforated cylinder 32 has a plate 50 located centrally therein and near the top to prevent fluid flow from the top central port 52 directly to the central core of the inner perforated cylinder 32. The plate 50 is equipped with a ball and seat valve. The ball is captured by a screen cage fastened to the upper surface of the seat plate 50. The cage prevents the ball from being carried away with the liquid.

The upper end of the inner perforated cylinder 32 opens into a top central port 52 formed within the top end cap 12. In like manner, the bottom end of the inner perforated cylinder 32 opens into a bottom central port 54 formed in the bottom end cap 14.

Formed in the top and bottom end caps 12 and 14 are respective annulus ports 56 and 58. The top annulus port 56 opens into an annular channel 60 formed in the top end cap 12. Similarly, the bottom annulus port 58 opens into an annular channel 62 formed in the bottom end cap 14. The annular channels 60 and 62 are in fluid communication with an annular chamber 64 located between the outer surface of the outer perforated cylinder 22 and the inside surface of the case 16.

In operation of the device 10, the desired media 40 is coupled to the media inlet channel 44 via external piping and valve arrangement. The media outlet channel is valved to a closed position. The media 40 is preferably coupled to the device in a liquified form so that it fills the media chamber 38, preferably above the plate 50. If the media 40 does not fill the media chamber 38 above the plate 50, then the influent could be short circuited from the top annulus port 56 directly to the central core of the inner perforated cylinder 32, without being filtered. Once the media chamber 38 is filled with the media 40, the inlet channel 44 and the outlet channel 42 are valved to a closed condition.

During an optional intermediate cycle, called a purge cycle, the media 40 is packed or otherwise caused to settle in the media chamber 38. During this cycle, a liquid is input into the central inlet port 52, and the bottom annulus port 58 is briefly opened to relieve the internal pressure of the device 10. This action allows the liquid to force the media 40 downwardly in the

media chamber 38 into a concentrated or packed condition. If needed, additional media 40 can be input into the media chamber 38 as a result of the purge cycle.

During a filter or coacting stage, the undesired matter is removed from the influent. The influent is coupled via external piping and valve arrangement to the top annulus port 56 and or the bottom annulus port 58. The influent is thus coupled to the annular chamber 64 that encircles the entire length of the outer perforated cylinder 22. The influent is forced in a radial direction through the media 40 located in the media chamber 38. chamber 38. The influent that passes through the media particles is effectively filtered or coacted. The filtered influent passes radially through the media 40 and through the openings in the inner perforated cylinder 34 and downwardly in the core of the inner perforated cylinder 34 to the central outlet port 54. From the central outlet port 54, the filtered liquid, i.e., effluent, is carried externally from the system to other equipment for further processing, or to terminal equipment.

The filter process continues until the media has accumulated particulate matter to the extent that the pressure in forcing the influent into the device 10 increases above a predefined threshold. When the device is used for coacting the influent with the media, the coacting cycle continues until there is an indication that the media is no longer effective in removing the desired chemical from the influent. In this event, a regeneration procedure or cycle can be instituted.

A system incorporating the device 10 is illustrated in Fig. 2. The regeneration stage is shown. The system includes a valve 72 controlling the outlet channel 42 of the device 10, and a pump (not shown) suited for pumping a liquid into the top central port 52 of the device 10. A container 78 is illustrated of the type adapted for removing particulate matter from the media 40, or regenerating the media 40 to reconstitute it to its pristine condition. The external valving arrangement is switched so that a liquid enters the device 10 via the top central port 52. The liquid is forced into the central core of the inner perforated cylinder 32. The ball in plate 50 forced closed in its seat by the pressure of the liquid. The liquid is thus forced to flow through the openings 34 in the top portion of inner perforated cylinder 32, and into the top of the column of media 40. This applies a downward force on the column of media 40. At the same time, the liquid is forced radially outwardly at the top of the media chamber 38 and into the annular chamber 64, to the bottom thereof. The liquid in the annular chamber 64 reenters the media chamber 38 at the bottom thereof and tends to liquify the media and flush it down the outlet channel 42, through the open valve 72 and to the container 78. Once the media 40 begins to fluidize and be carried out the outlet channel 42, there is an avalanche effect that results in the quick and efficient removal of the media 40 from the device 10.

The media is regenerated by conventional means in the container 78 or other regeneration system. In the event the media 40 are beads, the container can be equipped with equipment so that a liquid is forced into the bottom of the container with sufficient velocity so that the axial drag forces overcome the buoyant weight of the media beads, whereupon fluidization occurs and

the particulate matter is separated from the media and carried out of the top of the container 78. For other types of media chemicals, heat and other materials can be used to regenerate the media 40.

In accordance to an important feature of the invention, much less liquid is required during the regeneration cycle, as compared to prior art systems. In other applications, the container 78 may be physically located below the device 10, in which event the media 40 can be allowed to be fluidized by the action of gravity, and be carried to the container where it is regenerated.

Fig. 3 illustrates the system in the state in which the media is resupplied to the device 10. After the media 40 has been regenerated in the container 78, it is pumped by a pump 80 in a slurry through the open valve 82 to the inlet channel 44 of the device 10. The slurry of media 40 is carried into the media chamber 38 and fills it from bottom to the top thereof. The outlet channel 42 of the device can be vented to relieve internal pressure during the refilling cycle and expedite filling of the media chamber 38 with the regenerated media 40.

In other systems, one or more containers 78 can be utilized for regenerating the media 40. One container 78 can be employed to regenreate the media 40 and hold the regenerated media 40 until needed. While the device is operating to filter or coact an influent, the media chamber 38 is filled with the media 40. When it is time to regenerate the media, the media 40 can be carried from the device 10 to the second container where it is regenerated. During regeneration of the media 40 in the second container 78b, the regererated media 40 held in the firat container 78a can be pumped into the media chamber of the device 10 an it can be placed into operation during the regeneration of the spent media in the second container 78b.

This same process can be carried out with a number of devices 10a, 10b....10n as shown in Fig. 4. Here, a single container 78 can be employed to sequentially regenerate the media 40 from plural devices. In addition, plural containers can also be used to regenerate the media in a system of plural devices.

The foregoing system is well adapted for use with media that is difficult to fluidize within the device itself, as described in U.S. Pat. No. 6,322,704 by Martin. Such systems may include a device 10 using a zirconium powder as a media to filter arsenic form water. The zirconium media can be regenerated chemically in the container 78 or regeneration system.

From the foregoing, the various advantages of the invention are set forth below.

No backwash chamber needed, although could still be included where applicable.

No orifices needed for fluidization although could still be included where applicable, such as where periodic backwashing of the media is desirable.

One check valve approximately 4 - 5 inches down from the top of the inside cylinder to prevent channeling

of the fluid at the top during the filter cycle, if so desired or where needed.

Mechanism of fluidization out the bottom - Media itself replaces the resistances in both the outside annular and the inside cylinder to produce the axial forces required to discharge the media out of the filter.

Media may be completely removed to an external vessel separate from the filter.

End Caps contain media access thru ports, channels, grooves or other means so media can be discharged from the filter.

After media is discharged thru the bottom it may be followed by a filter or spray cycle to remove any of the media that may still be left up in the filter, especially any media that may be next to the inside of the outside filter screen.

Fluidization out the bottom provides a superior job of removing any media next to the inside of the outside filter screen compared to normal fluidization into a top backwash chamber.

The very real possibility exists that an otter solid shell that forms the annular space between the outside perforated filter chamber and the inside of such outside shell may not even be necessary which would allow for multiple element cases and other means of piping arrangement.

Filters may be placed vertically or horizontally and recharged in place or removed and regenerated either vertically or horizontally or even inverted.

A quick connect on the end cap could replace the port or channel and allow for quick media change out.

The regeneration stage can take place in the filter itself with or without a backwash chamber.

Lastly, there may be times when the regeneration process described in Fig. 2 can be done in the device 10 itself.

What Is Claimed Is:

1. A method of coacting an influent with a media, and for regenerating the media, comprising the steps of:

coacting the influent with the media by passing the influent radially through an annular column of the media contained in an annular-shaped media chamber;

removing the media out of the media chamber by fluidizing the media and carrying the media to a regeneration container; and

regenerating the media in the regeneration container; and

carrying the media from the regeneration container to the to the media chamber.

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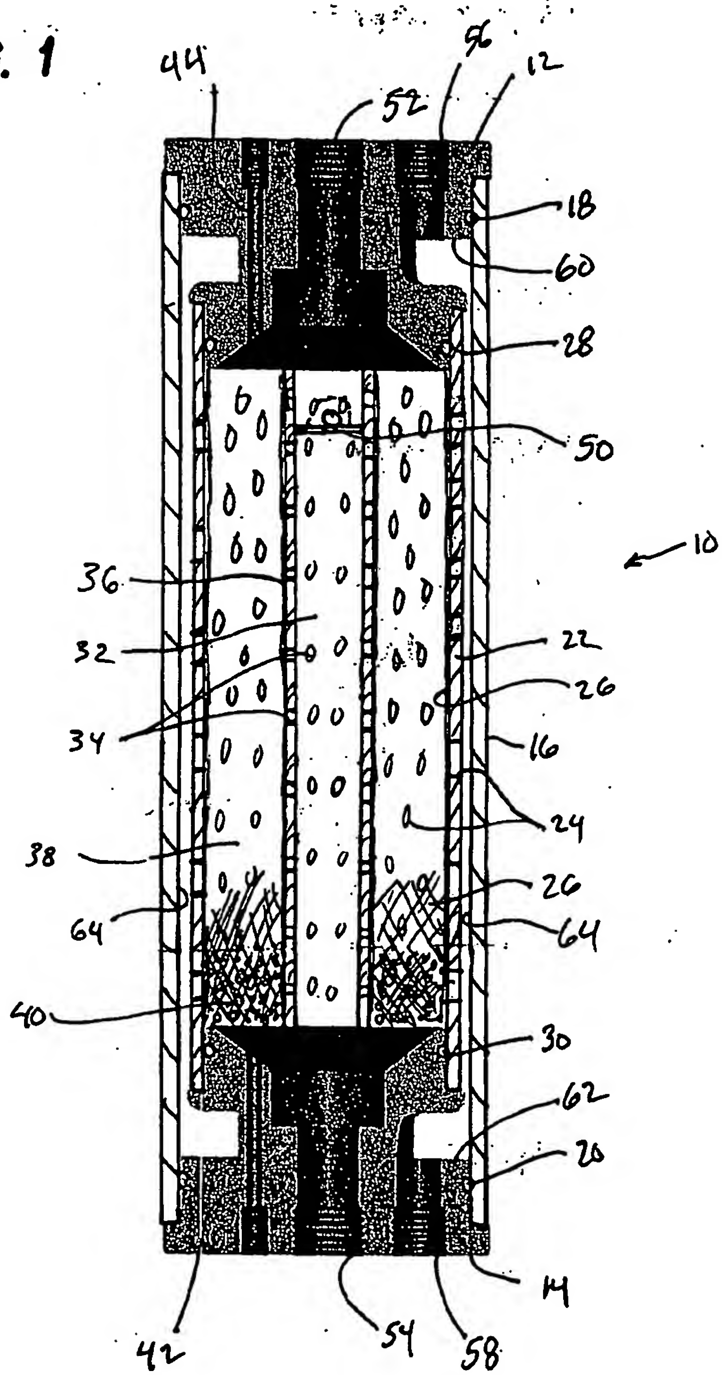
FIG. 1



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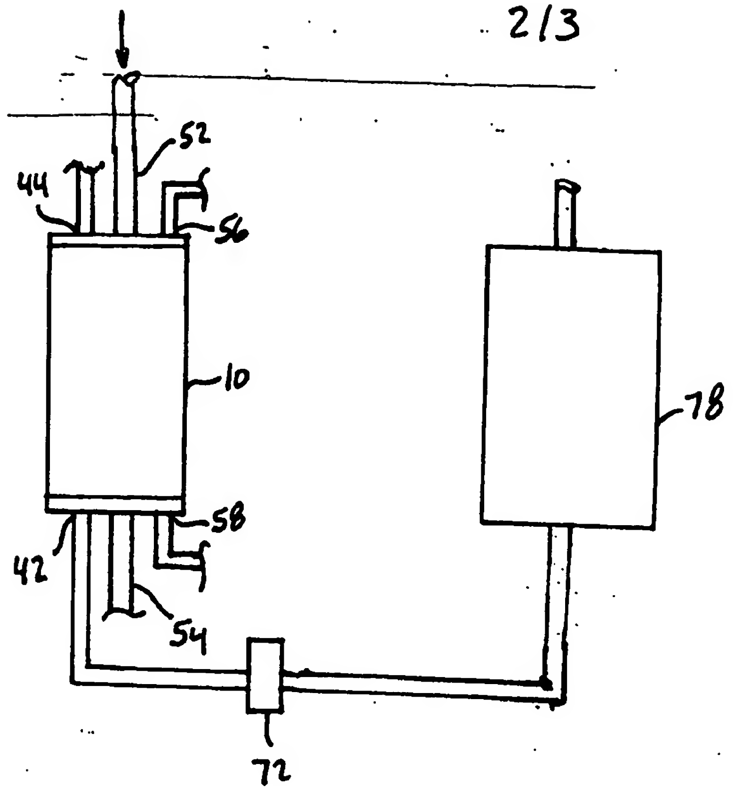

FIG. 2

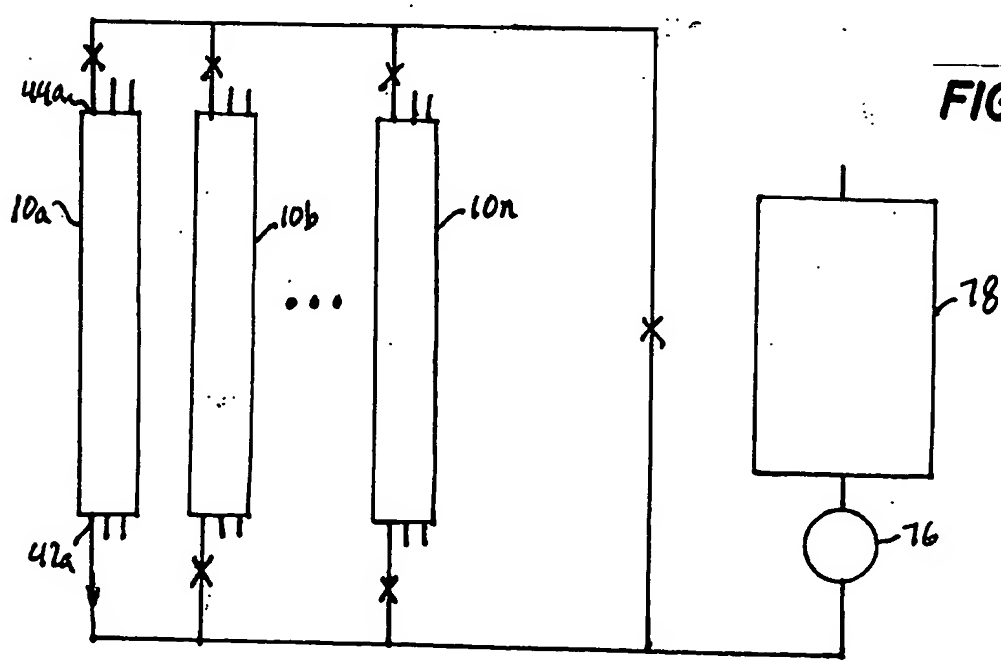

FIG. 4

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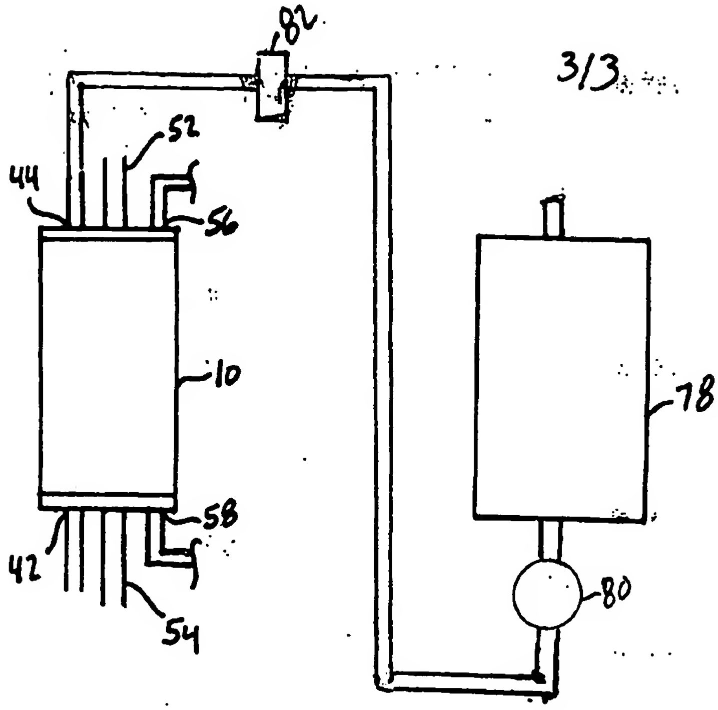

FIG. 3